

than half that of chlorine, and so little exceeding that of oxygen, that those who would suppose it to contain oxygen combined with an inflammable base, must suppose the base to be less than one twentieth part of the oxygen with which it combines.

*Catalogue of North Polar Distances of Eighty-four principal fixed Stars, deduced from Observations made with the Mural Circle at the Royal Observatory.* By John Pond, Esq. Astronomer Royal, F.R.S. Read July 8, 1813. [*Phil. Trans.* 1813, p. 280.]

*A Synoptic Scale of Chemical Equivalents.* By William Hyde Wollaston, M.D. Sec. R.S. Read November 4, 1813. [*Phil. Trans.* 1814, p. 1.]

The design of the scale here proposed by the author is to save chemists the labour of many troublesome computations in estimating the ingredients of neutral salts, and the reagents and precipitates by which these ingredients might be ascertained.

For though certain laws to which chemical union is subjected have of late been discovered, and have enabled chemists to determine with greater precision than formerly the composition of bodies submitted to be examined, and to express numerically the relation of the several elementary chemical substances to each other; nevertheless the computations requisite for applying these results to many objects of inquiry are frequently attended with considerable trouble.

The author briefly sketches the history of proportional chemistry, beginning with Bergman, who, perceiving that the same acid united to the same base, always in the same proportion, took pains to ascertain the composition of various salts. Kirwan followed the same line of endeavour to a greater extent, with a view to determine the proportions of various acids to different bases, as questions independent of each other. To these succeeded Richter, who gave connection to the subject by observing a new relation that had escaped the notice of Bergman, Kirwan, or any of his predecessors. They had observed only the constancy of the proportion of the same acid to the same base; Richter observed, further, a fixed relation of acid to acid: namely, that when the proportional quantities of any two acids, that are each sufficient to saturate a given quantity of any one base is determined, the same proportional weights of these acids will also saturate equal quantities of any other base; and consequently that if any quantity of sulphuric acid be assumed as standard, then equivalent quantities of all other acids may be conveniently expressed by fixed numbers, adapted to each; and the several quantities of different alkalies and earths that would each saturate the standard quantity, might also be represented constantly by corresponding numbers.

The observation of other proportions, which are simple multiples of the preceding, by Mr. Dalton and others, are noticed as affording an important correction of the best analyses; but it is observed that

the theory of atoms by which these facts are explained is by no means of importance to the present inquiry. It is by means of a series of numbers computed according to the method of Richter, that this scale is constructed so as to answer at one view the very numerous questions that occur to an analytic chemist in the examination of any saline compound. It is similar in principle to the common sliding rule, and like that instrument has the usual Gunter's line of numbers on the slider; but upon a line adjacent to the slider are marked certain points corresponding to those numbers which represent the various chemical elements, acids, alkalies, and other compounds intended to be included in the present view. By motion of the slider any one point of the line of numbers, as 100, may be made to correspond with the point indicating any compound, as sulphate of potash. By the position of the point for sulphuric acid, this salt is seen to contain 46 of acid, and the other ingredient potash at the same time corresponds with 54 on the slider. By the position of the point for sulphate of barytes, it appears that 135 of this precipitate would be obtained from 100 of the salt, and in the same manner that it would yield 176 of sulphate of lead, with a great variety of similar answers respecting the equivalent quantities of other compounds in which the same quantities of acid or neutralizing base is contained.

Since the line of numbers is so divided that a given space of every part of it corresponds to numbers that bear a given ratio to each other, and since the intervals on the adjacent column of equivalents are all laid down according to certain given portions of the same scale, they directly indicate by juxtaposition numbers that are in the same proportion on any part of the scale that may be presented to them, as will be very evident to those who are acquainted with the common properties of other sliding rules.

For the sake of those who may not be accustomed to the use of the sliding rule, and for the purpose of recommending that valuable instrument to more general use, the author enters rather more than might otherwise be requisite into the elementary principles of logometric division.

*Methods of clearing Equations of quadratic, cubic, quadrato-cubic, and higher Surds.* By William Allman, M.D. Communicated by the Right Hon. Sir Joseph Banks, K.B. P.R.S. Read July 8, 1813. [*Phil. Trans.* 1814, p. 23.]

In a paper communicated to the Royal Irish Academy by Dr. Mooney, the method of exterminating any number of quadratic surds is pointed out by successively squaring them when brought alone to one side of the equation; and the present is an extension of the same method: first, to all surds whose indices are any integral power of 2, as the fourth, eighth, sixteenth, thirty-second power, &c.; and next to cubic surds, and to any number of surds whose common indices are in any manner compounded of the factors 2 and 3; next